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Interlaboratory Study MOE 04-01

Toxicity Characteristic Leachate Procedure
(TCLP)

January 21, 2005

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1. INTRODUCTION

This work was conducted as a supplementary project to Interlaboratory Study 2002-1: Toxicity Characteristic Leachate Procedure (TCLP)¹. This follow-up study was based on the examination of two leachates and two waste materials and the application of a prescribed TCLP. This report provides a preliminary statistical summary of the results. Another report is planned which will incorporate a detailed scientific evaluation of the two studies, including a detailed comparison of the outcomes. Refer to Study 2002-1¹ for further details regarding the basic principles of the TCLP methods used.

A letter of invitation was sent to members of the Canadian Association for Environmental Analytical Laboratories (CAEAL) and other Analytical Laboratories in January of 2004. Samples were dispatched to all participants on March 8, 2004 along with a study protocol document and instructions. All new participants were also provided a copy of the previous study report¹ and Ontario Ministry of Environment Method E9002: The Preparation of Leachates Using the Toxicity Characteristic Leaching Procedure (TCLP)². Each laboratory was assigned a confidential laboratory identification code. A list of participating laboratories is provided in Appendix 2. A copy of all correspondence is provided in Appendix 3.

1.1 STUDY INFORMATION

The target parameters for this study were trace metals which included the previous study metals as well as additional common metals that are typical to this analysis, as listed in Table 1. This design will provide additional information for the participants and the Ontario Ministry of Environment, Laboratory Services Branch (MOE-LSB).

Table 1: Study Target Analytes

Aluminum (Al)*	Copper (Cu)	Silver (Ag)*
Arsenic (As)*	Iron (Fe)	Strontium (Sr)
Barium (Ba)*	Lead (Pb)*	Titanium (Ti)
Beryllium (Be)	Magnesium (Mg)	Uranium (U)*
Cadmium (Cd)*	Manganese (Mn)	Vanadium (V)
Calcium (Ca)	Molybdenum (Mo)	Zinc (Zn)
Chromium (Cr)*	Nickel (Ni)	
Cobalt (Co)	Selenium (Se)*	

* Regulated parameters

2.0 STUDY DESIGN

The study was designed to assess the TCLP testing for the trace metals listed in Table 1. Each participant received two fortified leachates and two solid waste samples to be processed through the prescribed TCLP and analyzed for the target trace metals.

In the original study, participants were requested to follow the MOE-LSB method E9002 which is an adaptation of the US-EPA method 1311. In the study reported here, in addition to method E9002, further instructions were provided to ensure uniform application of the method by all participants. These instructions were mandatory and included:

- 1) The omission of steps that determine the choice of extraction fluid
- 2) Use of extraction fluid #2
- 3) Use of a ratio of 1:20 for waste solid/extraction fluid
- 4) Extraction for 18 ± 2 hours by tumbling at 30 rpm
- 5) Filtration using 0.7 micron acid-washed glass fibre
- 6) Preservation of final leachate at a pH less than 2

Further details may be found in the instruction sheets provided to the study participants (Appendix 3).

2.1 Leachate Sample Preparation

A dry garden soil sample was collected and stored in a plastic garbage bag at 4°C .

A leachate was prepared from this soil sample using multiple 50 g portions extracted with 1000 ml portions of leaching fluid 2 (5.7 mL glacial acetic acid per 1.0 L of reagent water to a pH of 2.88 ± 0.05) as per the study leaching process. The final filtered portions were combined in a 20 L carboy. The bulk leachate was preserved with nitric acid to a pH<2. The entire solution was spiked to give a final metal concentration close to regulation limits (Table 2).

Half of the above solution was bottled as Leachate #1.

The remaining portion of leachate in the carboy was again spiked with selected analytes to increase the concentration to a slightly higher level. This was bottled as Leachate #2.

Spike design was at the regulation limit and slightly above, with the exception of As, which was the same in both solutions.

Table 2: Design limits for spiked leachate, MOE 04-01

Metal, mg/L	As	Cd	Cr	Pb	Se	U
Leachate # 1	3.2	0.5	5	5	1	10
Leachate # 2	3.2	0.65	6.5	6.5	1.3	13

2.2 Solid Waste Sample Preparation

The Solid Waste samples were the same as was used in Study 2002-12¹. The two samples were prepared by mixing two industrial wastes in varying amounts. Geoscience Laboratories of Sudbury, Ontario, certified to ISO 9001 standards, was contracted to perform the physical processing. The stages of processing included air drying, sieving, milling, mixing, dispensing into bottles and labeling.

2.3 Sample Distribution

Sample sets, consisting of two Leachates of approximately 250 mL in Polyethylene Terephthalate (PET) bottles, and two Solid Wastes of 110 g each, were sent by courier to the participants on March 8, 2004. An instruction sheet and report form were electronically sent to all participants, as well as a methodology questionnaire.

3.0 STUDY RESULTS

Twenty-eight laboratories participated in this study. Individual results as they were received were transferred into an electronic spreadsheet. Preliminary tables of results were forwarded to participants on May 17, 2004 to verify the accuracy of transcription. Seven laboratories responded with requests for change. All participating laboratories submitted results electronically via e-mail. The corrected raw data are presented in Appendix 1 - Tables 13A to 16B.

4.0 STUDY EVALUATION

For each sample, the study average and standard deviation were computed for each analyte by robust techniques as described in "Statistical methods for use in proficiency testing by interlaboratory comparisons", Draft International Standard ISO/DIS 13528³. By this technique less weight is assigned to extreme results, rather than eliminating them from the data set. Results that were reported with a "less than" qualifier such as <, <MDL etc. were not included in the estimation. Only analytes for which the majority of laboratories reported positive results (i.e. greater than laboratory detection limit) were evaluated.

Z numbers were calculated as⁴:

$$Z = (\text{Result} - \text{Robust Average}) / \text{Robust standard deviation}$$

If Z is between -2 and 2, performance is satisfactory

S

If Z is between -2 and -3 or between 2 and 3, performance is questionable (Warning)

W

If Z is -3 or > 3, performance is unsatisfactory (Corrective action recommended)

A

The evaluation findings are presented in Tables 3 to 12.

TABLE 3
LEACHATE SAMPLES: Metal Concentrations as Reported by Participants
Statistical Data

	Al	As	Ba	Cd	Ca	Cr	Co	Cu	Fe	Pb	Mg	Mn	Mo	Ni	Se	Sr	U	Zn
Robust Avg mg/L	0.709	3.28	0.507	0.501	1101	4.64	0.0196	0.359	22.2	4.76	110	7.04	0.0435	0.603	1.02	2.22	9.60	7.78
Robust SD mg/L	0.137	0.306	0.0328	0.0511	65.4	0.479	0.00229	0.0503	1.89	0.410	8.52	0.612	0.00816	0.0714	0.122	0.211	1.08	0.721
Robust RSD N	19.3% 27	9.3% 27	6.5% 25	10.2% 27	5.9% 25	10.3% 21	11.7% 21	14.0% 26	8.5% 27	8.6% 27	7.7% 25	8.7% 26	18.8% 24	11.8% 25	12.0% 27	9.5% 26	11.3% 25	9.3% 26
Robust Avg mg/L	0.712	3.33	0.510	0.642	1098	6.08	0.0196	0.360	22.1	6.21	110	7.16	0.0438	0.603	1.13	2.23	12.5	7.73
Robust SD mg/L	0.132	0.256	0.0296	0.0645	72.5	0.515	0.00175	0.0462	1.830	0.472	8.63	0.460	0.00641	0.0679	0.155	0.208	1.17	0.728
Robust RSD N	18.5% 27	7.7% 27	5.8% 25	10.0% 27	6.6% 25	8.5% 27	8.9% 21	12.8% 26	8.3% 27	7.6% 27	7.9% 25	6.4% 26	14.6% 23	11.3% 25	13.7% 27	9.3% 26	9.4% 24	9.4% 27

NOTE: Results of Lab ID 4111 were not included in the estimation of study average and standard deviation.

TABLE 4
LEACH 1: Z Scores

Lab ID	Al	As	Ba	Cd	Ca	Cr	Co	Cu	Fe	Pb	Mg	Mn	Mo	Ni	Se	Sr	U	Zn
4101	-0.6	1.3	-1.4	-1.1	-7.0	1.6	1.6	-0.9	-0.2	1.2	-0.6	1.7	-0.2	0.8	0.8	0.8	1.3	
4102	2.2	-2.5	0.2	0.7	2.1	0.8	0.2	-4.8	1.1	-0.0	1.4	0.8	0.8	0.3	1.9	0.2		
4103	0.0	-2.5	NE	0.5	-0.9	-1.0	43.9	0.8	0.4	0.8	-1.3	0.5	NE	2.0	-0.1	-3.9	NE	
4104	-0.8	0.0	1.8	-0.8	0.7	-1.0	-0.8	-0.5	-0.4	-0.9	0.6	-0.2	-0.3	-0.7	1.2	0.4	0.4	
4105	-0.2	-0.5	-2.2	-2.0	-0.3	-1.3	-5.9	-0.4	-1.8	-1.3	-1.3	-1.4	-1.0	-1.7	-0.5	-2.0	-1.2	
4106	-0.4	0.0	0.4	0.1	0.5	0.3	0.2	0.2	0.7	0.2	-1.5	-1.6	0.3	-0.0	-0.1	-0.3	-0.1	
4107	2.1	0.1	0.4	-0.5	0.1	-0.6	-0.3	0.5	-0.2	-0.6	0.4	0.3	-2.6	-0.4	-1.3	-0.4	-0.8	
4109	-0.1	-0.2	0.4	0.0	-1.5	0.0	-0.7	0.0	-0.5	0.0	-1.1	-0.5	-0.4	-0.0	-0.6	-0.4	-0.2	
4110	0.0	0.1	0.4	0.5	0.7	0.1	0.2	-0.3	1.0	-0.1	-0.0	-0.3	-1.3	0.7	0.2	-0.1	0.4	
4111	-0.8	-0.3	-0.9	-0.1	2.6	1.2	0.1	0.2	2.2	1.0	-0.4	1.6	0.8	0.3	-1.1	-0.0	1.9	
4113	0.1	-0.1	-0.1	-0.4	-1.5	-0.3	NE	-0.0	-0.8	-0.2	-0.4	0.2	-0.3	-0.1	-0.5	-0.3	-0.7	
4116	0.7	0.8	1.2	0.9	0.6	0.3	1.0	2.2	-0.0	0.2	0.1	-0.2	0.2	0.5	0.4	0.5	0.8	
4117	-0.6	1.0	0.8	0.0	-1.2	0.8	2.1	0.3	0.4	-0.0	-0.6	-0.1	0.6	0.1	2.1	0.5	-0.7	
4118	-1.0	NE	-1.1	0.6	-1.5	-1.1	-1.0	-1.5	-1.1	-0.5	-2.9	-0.7	-0.2	-0.8	-1.9	-0.7	-2.7	
4119	1.6	0.6	0.1	-0.7	-0.2	-0.3	-0.2	-0.3	0.5	-0.4	-0.2	-0.2	-0.7	4.7	-0.3	-0.4	-1.1	
4120	0.7	0.4	0.6	-0.2	0.6	1.0	0.2	0.2	0.4	0.0	1.0	0.8	0.7	0.6	-0.5	0.6	1.4	
4121	-2.1	0.4	0.4	-0.0	-0.0	0.3	NE	14.9	1.0	0.6	1.2	1.4	NE	NE	-0.4	-0.1	-0.5	
4122	-0.3	0.7	-0.2	1.9	NE	1.2	NE	-1.1	0.9	0.8	NE	0.4	-0.8	1.4	0.7	-0.8	1.0	
4124	-1.3	-1.0	-1.1	0.9	0.7	0.3	NE	1.3	0.5	1.8	1.0	-2.6	25.3	-0.3	5.5	0.1	-0.9	
4125	-0.2	-0.3	-0.2	-0.0	-0.0	0.7	0.2	-1.1	1.1	0.6	-0.0	-0.7	-0.4	-0.0	-0.1	-1.0	-0.9	
4126	3.9	-1.0	-2.0	-3.0	-1.4	-2.0	NE	-3.1	-2.4	-1.1	0.6	NE	-0.2	-1.3	-0.6	NE		
4130	-0.3	-1.1	0.5	0.5	-0.0	-0.5	-0.7	0.9	-1.0	-0.8	0.5	-0.1	0.4	-0.4	6.4	-0.7	0.9	
4133	0.1	1.0	-0.6	0.2	0.6	0.4	-4.2	0.3	0.3	-0.3	0.9	NE	0.8	1.1	-2.8	0.4	9.1	
4136	1.0	2.7	0.1	1.4	0.6	0.4	1.1	1.6	0.6	1.2	1.3	0.8	0.8	1.5	1.1	0.4	0.6	
4137	0.4	0.1	0.1	0.4	-0.0	-0.1	-0.7	0.3	-0.6	-0.1	0.7	-0.1	-0.2	-1.3	0.7	0.8	-0.2	
4138	-3.6	-0.1	-5.7	-2.2	NE	-4.0	0.2	-1.3	-5.0	-4.2	NE	-0.8	-4.1	-3.4	-1.4	NE	-3.3	
4139	0.1	-1.0	0.0	0.4	1.2	-0.2	0.6	0.3	1.3	0.4	2.1	0.4	0.3	0.2	-0.3	0.0	0.0	
4140	-0.1	1.4	1.6	1.5	0.1	1.4	0.6	0.3	0.4	0.3	2.3	0.3	-4.6	1.0	1.1	0.7	2.2	

NE = Not Evaluated

TABLE 5
LEACH 1: Performance Summary
S = Satisfactory W = Warning A = Corrective Action Recommended
NE = Not Evaluated

LAB ID	Zn	S S S S S S S S S S S S S S S S S S W S S S W S S S NE S S S S A S S
	U	A S NE S
	Sr	S S A S
	Se	S A S
	Ni	S S
	Mo	S S
	Mn	S A
	Mg	S NE W S
	Pb	S S S S S S S S S S S S S S S S S S W S S S S S S S S S S S S S S S S S S S A S W
	Fe	S S S S S S S S S S S S S S S S S S W S S S S S S S S S S S S S S S S S S S
	Cu	S A S
	Co	NE S A S S A S
	Cr	S S
	Ca	A W S S S S S S S S S S W S
	Cd	S S
	Ba	S S NE S W S
	As	S W W S
	AI	S W S

TABLE 6
LEACH 2: Z Scores

LAB ID	AI	As	Ba	Cd	Ca	Cr	Co	Cu	Fe	Pb	Mn	Mg	Ni	Se	Sr	U	Zn
4101	-0.6	1.1	-1.4	-0.8	-6.2	1.2	NE	-1.1	0.1	1.0	-0.5	1.2	-0.3	-0.6	0.6	1.0	-5.0
4102	1.3	-2.6	-0.3	0.6	1.3	0.6	0.2	-5.6	1.0	-0.2	0.1	1.3	1.0	0.5	-3.3	0.3	1.2
4103	0.0	-3.2	NE	0.0	-0.8	-1.1	57.4	0.7	0.4	0.5	-1.2	0.4	NE	2.1	-2.1	0.3	1.7
4104	-1.1	-0.3	1.7	1.0	-0.9	0.3	-1.0	-0.8	-0.0	0.4	0.7	-0.1	-0.6	-0.8	-0.5	1.0	-0.1
4105	-0.6	-2.6	-1.9	-0.2	-1.5	-8.4	-0.4	-1.8	-1.6	-0.2	-1.2	0.2	-1.2	-1.8	-0.1	-2.0	-1.1
4106	-0.3	-0.3	0.4	0.1	0.3	0.1	-0.4	0.1	0.5	0.1	-1.2	-2.4	0.5	-0.0	-0.2	0.6	-0.1
4107	2.2	-0.3	0.3	-0.6	0.4	0.1	-0.9	0.6	-0.1	-0.9	-0.4	0.2	-3.4	-0.2	-0.7	-1.4	-0.5
4109	0.1	0.1	0.7	0.4	-0.9	0.4	0.2	0.2	-0.1	0.3	-0.8	-0.8	1.0	0.4	-0.3	0.0	0.3
4110	-0.3	0.3	0.0	1.0	0.7	0.0	0.1	0.0	1.0	-0.0	0.0	-0.8	-1.7	0.8	0.4	-0.1	0.6
4111	-0.9	-0.5	-1.4	-0.1	2.7	1.7	0.8	0.1	2.2	0.9	-0.4	1.8	-0.6	0.2	-1.2	0.0	1.9
4113	0.1	-0.2	-0.2	-0.4	-1.4	-0.5	NE	-0.2	-0.9	-0.4	-0.4	0.3	-0.1	-0.2	-0.6	-0.4	-0.8
4116	0.5	0.8	1.3	0.9	0.3	0.4	0.3	0.4	2.3	-0.0	0.1	0.1	0.0	0.2	0.6	0.5	1.8
4117	-1.9	0.9	0.6	0.1	-1.1	0.6	2.2	0.1	0.3	-0.2	-0.6	-3.7	0.7	-0.1	0.2	-0.8	-0.8
4118	-1.1	-1.3	NE	-1.1	0.6	-2.0	-0.9	-1.1	-1.6	-3.4	-0.6	-0.5	-0.9	-2.1	-0.8	2.5	-2.6
4119	2.1	0.6	0.1	-0.7	1.3	-0.3	-0.4	0.5	-0.3	-0.4	-0.2	0.7	0.2	-0.4	0.1	-0.4	-0.1
4120	0.7	0.4	0.7	-0.1	-0.2	0.6	0.6	0.0	0.5	0.6	1.0	1.7	0.5	0.6	-0.5	0.6	0.9
4121	-0.6	0.7	0.7	0.9	0.0	0.6	NE	0.9	1.0	0.2	1.2	1.1	NE	NE	-0.1	-0.6	1.9
4122	-0.1	0.3	-0.3	0.9	NE	1.4	NE	-1.3	0.9	0.8	NE	0.2	-0.0	-0.0	-0.5	1.1	-0.6
4124	-1.0	1.3	-1.0	1.2	1.0	NE	1.1	1.1	1.9	1.4	0.1	-6.8	0.4	3.6	0.3	-0.9	0.6
4125	-0.5	-0.9	-0.3	-0.7	-1.3	-0.2	0.2	-1.3	0.8	-0.4	-1.1	-0.9	-0.6	-0.0	-0.8	-1.1	-1.0
4126	3.7	-0.1	-2.3	-2.9	-1.1	-2.3	NE	NE	-3.0	-2.7	-1.0	1.0	NE	NE	0.2	-1.3	-1.2
4130	-0.3	-1.3	0.7	0.4	0.0	-0.8	-0.9	1.1	-1.0	0.9	0.5	-0.3	1.1	-0.4	3.9	-0.8	-0.6
4133	0.6	-0.1	-0.6	0.1	0.7	0.3	0.2	0.2	0.4	-0.4	0.9	NE	1.0	1.7	0.1	0.8	4.3
4136	0.9	3.1	-0.1	1.3	0.6	1.0	0.8	1.7	0.2	1.3	0.8	0.5	0.8	1.2	0.7	1.0	1.0
4137	0.5	0.3	0.0	0.3	0.0	-0.3	-2.1	0.2	-0.6	-0.2	0.5	-0.3	-0.1	-1.4	0.5	0.8	-0.2
4138	-3.7	0.2	-6.1	NE	-4.6	0.2	-1.3	-4.9	-4.5	NE	-0.9	-5.3	-3.3	-1.5	NE	NE	-3.1
4139	0.3	-1.3	0.3	0.6	0.9	-0.3	0.8	0.2	1.9	0.3	2.1	-0.1	0.3	0.4	-0.5	0.1	0.0
4140	-0.3	1.1	1.4	1.2	-0.5	1.4	-0.2	0.2	-0.6	1.9	-0.1	-6.0	1.1	1.1	0.5	0.3	2.1

NE = Not Evaluated

TABLE 7

LEACH 2: Performance Summary
 S = Satisfactory W = Warning A = Corrective Action Recommended
 NE = Not Evaluated

LAB ID	Zn	U	Sr	Se	Ni	Mo	Mn	Mg	Pb	Fe	Cu	Co	Cr	Ca	Cd	Ba	As	AI
4101	S	S	S	S	S	S	S	S	W	S	S	S	S	S	S	S	A	S
4102	S	S	S	S	S	S	S	S	S	S	S	S	S	S	S	S	S	S
4103	S	S	S	S	S	S	S	S	S	S	S	S	S	S	S	S	S	S
4104	S	S	S	S	S	S	S	S	S	S	S	S	S	S	S	S	S	S
4105	S	S	S	S	S	S	S	S	S	S	S	S	S	S	S	S	S	S
4106	S	S	S	S	S	S	S	S	S	S	S	S	S	S	S	S	S	S
4107	W	S	S	S	S	S	S	S	S	S	S	S	S	S	S	S	S	S
4109	S	S	S	S	S	S	S	S	S	S	S	S	S	S	S	S	S	S
4110	S	S	S	S	S	S	S	S	S	S	S	S	S	S	S	S	S	S
4111	S	S	S	S	S	S	S	S	S	S	S	S	S	S	S	S	S	S
4113	S	S	S	S	S	S	S	S	S	S	S	S	S	S	S	S	S	S
4116	S	S	S	S	S	S	S	S	S	S	S	S	S	S	S	S	S	S
4117	S	S	S	S	S	S	S	S	S	S	S	S	S	S	S	S	S	S
4118	S	S	S	S	S	S	S	S	S	S	S	S	S	S	S	S	S	S
4119	W	S	S	S	S	S	S	S	S	S	S	S	S	S	S	S	S	S
4120	S	S	S	S	S	S	S	S	S	S	S	S	S	S	S	S	S	S
4121	S	S	S	S	S	S	S	S	S	S	S	S	S	S	S	S	S	S
4122	S	S	S	S	S	S	S	S	S	S	S	S	S	S	S	S	S	S
4124	S	S	S	S	S	S	S	S	S	S	S	S	S	S	S	S	S	S
4125	S	S	S	S	S	S	S	S	S	S	S	S	S	S	S	S	S	S
4126	A	S	S	S	S	S	S	S	S	S	S	S	S	S	S	S	S	S
4130	S	S	S	S	S	S	S	S	S	S	S	S	S	S	S	S	S	S
4133	S	S	S	S	S	S	S	S	S	S	S	S	S	S	S	S	S	S
4136	S	S	S	S	S	S	S	S	S	S	S	S	S	S	S	S	S	S
4137	S	S	S	S	S	S	S	S	S	S	S	S	S	S	S	S	S	S
4138	A	S	S	S	S	S	S	S	S	S	S	S	S	S	S	S	S	S
4139	S	S	S	S	S	S	S	S	S	S	S	S	S	S	S	S	S	S
4140	S	S	S	S	S	S	S	S	S	S	S	S	S	S	S	S	S	S

TABLE 8
WASTE 1 and WASTE 2: Metal Concentration as Reported by Participants
Statistical Data

	Ba	Ca	Cd	Cr	Cu	Fe	Mg	Mn	Mo	Pb	Sr	Zn
Robust	0.346	1819	0.625	0.186	0.0233	0.775	88.7	0.425	0.164	0.292	1.02	27.3
Avg												
mg/L												
Robust	0.0806	194	0.500	0.0902	0.0181	1.41	18.9	0.402	0.165	0.245	0.148	27.3
SD												
mg/L												
RSD	23.3%	10.7%	80.0%	48.5%	77.7%	181.9%	21.3%	94.6%	100.6%	83.9%	14.5%	100.0%
N	24	25	24	26	19	15	25	24	23	24	26	26
WASTE 2												
Robust	0.448	1786	1.69	0.125	0.0395	0.661	104	1.95	0.0526	0.971	1.02	98.5
Avg												
mg/L												
Robust	0.0994	200	0.720	0.0692	0.0266	1.13	22.2	0.844	0.0397	0.605	0.135	87.6
SD												
mg/L												
RSD	22.2%	11.2%	42.6%	55.4%	67.3%	171.0%	21.3%	43.3%	75.5%	62.3%	13.2%	88.9%
N	25	25	25	25	19	17	25	25	21	26	26	26

TABLE 9
WASTE 1: Z Scores

LAB ID	Ba	Ca	Cr	Cd	Cu	Mg	Mn	Mo	Pb	Sr	Zn
4101	-2.7	-7.7	NE	8.7	NE	0.0	NE	13.4	-0.8	-4.2	-1
4102	-0.6	0.1	-1.2	1.9	NE	-0.6	-1.0	1.1	NE	-1.1	-1
4103	NE	-1.5	-1.2	1.1	1.8	-0.4	-2.1	-1	3.7	-0.3	-0.9
4104	0.1	1.1	0.1	-0.7	-1.2	NE	-0.1	-0.4	-0.6	-0.1	0.3
4105	-0.9	-1.3	-0.9	-0.0	-1.0	-0.5	-0.3	-0.3	-0.9	-1.2	-0.8
4106	5.9	0.1	0.0	-0.4	0.9	1.3	-0.7	-0.1	-0.5	-1.1	0
4107	0.5	0.3	0.5	-0.4	1.5	-0.4	0.7	1.2	-0.8	0.5	0.9
4109	0.4	-0.8	0.5	-0.6	-0.5	NE	-0.3	0.3	-0.6	0.5	-0.1
4110	1.2	0.4	-0.4	0.0	-0.3	NE	-0.4	-0.7	-0.3	0.5	-0.5
4111	-2.3	-5.8	-1.2	9.5	NE	0.5	-4.7	NE	11.7	-1.2	-3.9
4113	2.2	1.1	6.7	-1.1	7.0	NE	2.3	11.3	NE	15.3	30.3
4116	-0.2	0.3	-0.1	-0.4	0.1	-0.5	-0.3	-0.4	-0.6	-0.0	0.2
4117	0.1	-1.3	-0.6	0.1	NE	-0.5	-0.5	-0.8	-0.3	-0.7	-0.7
4118	NE	2.6	2.6	-1.2	0.5	-0.5	3.7	3.6	-0.8	1.9	7
4119	-1.6	-2.5	NE	6.1	NE	NE	-3.4	NE	10.2	NE	-2.3
4120	0.3	0.1	1.1	-0.5	-0.3	-0.3	1.4	1.3	-0.7	1.0	1.4
4121	5.6	-0.5	-0.1	0.2	NE	3.8	-0.5	0.8	NE	1.2	-0.8
4122	-0.6	NE	0.8	-1.0	NE	-0.5	NE	0.6	-0.7	0.8	-0.5
4124	NE	0.8	1.0	NE	NE	0.4	0.3	NE	1.0	0.4	0.8
4125	-0.6	0.4	-0.9	0.2	NE	0.4	-0.0	-0.8	0.2	-0.8	-0.1
4126	-0.1	-0.3	NE	0.5	NE	NE	-0.9	NE	NE	-0.4	-0.9
4130	0.0	0.8	-1.0	-0.6	NE	0.8	1.6	-0.7	0.6	-0.6	1.2
4133	-0.7	0.2	0.7	0.2	-0.4	0.5	0.7	-0.2	1.8	-1.0	0.5
4136	0.3	0.5	-1.1	2.0	-0.5	-0.4	0.8	-0.9	0.9	-0.9	1.0
4137	0.3	0.4	-0.9	0.7	0.1	NE	0.1	-0.9	0.1	-0.8	0.5
4138	-2.2	NE	0.0	-1.5	-0.7	NE	-2.2	-0.2	-0.8	-0.4	NE
4139	0.2	0.6	0.7	-0.2	-0.5	3.1	0.8	0	-0.6	0.6	0.4
4140	0.2	-0.1	-0.1	0.3	NE	0.2	-0.7	-0.1	-0.7	-0.1	-0.7

NE = Not Evaluated

TABLE 10
WASTE 1: Performance Summary
S = Satisfactory W = Warning A = Corrective Action Recommended
NE = Not Evaluated

Zn	S S S S S S S S S S A S S S A NE	S S S S S S S S S S S S S S S S S S
Sr	A S S S S S S S S A S S S S A W	S S S S S S S S S S S S S S S S S S NE
Pb	S NE S S S S S S S S A S S S S NE	S S S S S S S S S S S S S S S S S S NE
Mo	A S A S S S S S S S A NE	S S S S S A S NE S NE S NE S S S S S S S
Mn	NE S S S S S S S S NE	A S S S A NE S S S S S S NE S S S S S S S S
Mg	NE S W S S S S S S A W S S A A S S S NE	S S S S S S S S S S S S S S S S W S S
Fe	S NE S NE S S S NE NE S NE S S S NE	S A S NE S NE S NE S NE S S NE NE S NE A NE
Cu	NE NE S S S S S S NE	A S NE
Cr	A S S S S S S S S A S S S S A S S S S NE	S S S S S S W S S S S S S S S S S S S
Cd	NE S S S S S S S S A S S W NE	S S S S S S S S S S S S S S S S S S S
Ca	A S S S S S S S A S S S W W S S NE	S S S S S S S S S S S S S S S S S S S NE S S
Ba	W S NE S S S S A W W S S NE	S S S S S S S S S S S S S S S S S S S W S S
-AB ID	4101 4102 4103 4104 4105 4106 4107 4109 4110 4111 4113 4116 4117 4118 4119 4120 4121 4122 4124 4125 4126 4130 4133 4136 4137 4138 4139 4140	

TABLE II
WASTE 2: Z Scores

LAB ID	Ba	Ca	Cr	Cu	Fe	Mg	Mn	Mo	Pb	Sr	Zn
4101	-3.2	-7.5	NE	9.7	NE	8.0	NE	49.8	-1.3	-5.0	-1.1
4102	-0.5	0.5	-0.2	-0.1	NE	NE	-0.3	-0.6	-0.6	-0.7	-0.4
4103	NE	-1.1	-2.1	1.2	30.5	0.5	-1.6	-2.2	NE	-1.2	-1.1
4104	-0.3	1.4	0.1	-0.6	-0.9	NE	-0.6	-1.0	0.6	0.3	0.3
4105	-0.1	-2.3	1.1	-1.1	0.7	-1.6	-0.3	2.9	-0.8	2.8	-1.9
4106	4.2	0.0	-0.2	-0.4	1.8	-0.9	-1.0	0.1	-0.3	-0.2	0.4
4107	0.4	0.6	-0.3	-0.0	0.4	-0.6	0.7	0.4	-0.8	-0.1	-0.6
4109	0.1	-1.3	0.2	-0.5	-0.6	NE	-0.9	0.0	-0.6	0.3	-0.7
4110	1.6	0.4	0.2	0.0	-0.3	NE	-0.2	-0.2	-0.1	0.1	0.5
4111	-2.7	-5.4	-2.3	11.4	NE	0.6	-4.7	NE	50.3	-1.6	-4.3
4113	2.9	0.4	4.1	-0.6	6.1	NE	1.3	4.8	NE	7.3	0.4
4116	-0.0	0.2	-0.2	-0.4	0.3	-0.9	-0.0	-0.2	-0.4	0.3	10.7
4117	0.0	-1.1	-0.3	-0.3	-0.8	-0.8	-0.6	-0.8	0.8	-0.5	-0.4
4118	NE	1.9	1.8	-0.9	0.9	-1.4	2.0	2.1	-0.8	1.6	2.5
4119	-2.0	-2.9	NE	5.5	NE	-2.8	NE	27.6	NE	-2.6	NE
4120	0.5	0.3	0.9	-0.3	0.1	-0.9	0.6	1.1	0.5	1.5	1.0
4121	2.7	0.8	-0.4	0.9	0.9	NE	0.2	1.2	-0.1	NE	-0.6
4122	-0.5	NE	0.7	-0.4	NE	-0.9	NE	0.2	-0.6	0.9	-0.6
4124	0.4	0.8	1.4	NE	NE	-0.6	0.3	0.4	NE	0.8	0.3
4125	-0.5	0.1	-0.7	-0.4	NE	-0.9	-0.2	-0.4	NE	-0.3	0.6
4126	-0.3	-0.5	-0.8	NE	NE	NE	-1.1	-0.2	NE	-0.4	-0.5
4130	-0.1	0.2	1.3	-0.9	-0.0	-1.4	-0.1	1.2	-0.8	1.0	-1.1
4133	-1.1	0.2	-0.8	88.2	-0.7	77.5	0.5	0.6	10.3	-0.6	0.6
4136	-0.3	0.5	-1.7	1.6	-0.7	0.8	1.3	-1.5	2.2	-1.1	-1.0
4137	0.0	0.1	-0.7	-0.1	-0.2	NE	-0.1	-1.0	-0.2	-0.5	0.6
4138	-2.4	NE	-0.7	-1.2	-1.1	NE	-0.4	-0.9	-0.8	NE	0.4
4139	0.2	0.8	-0.4	0.1	-1.0	-0.5	1.3	-0.0	0.1	-0.4	0.8
4140	0.3	-0.4	-0.2	-0.6	-0.2	-0.6	-0.3	-0.0	-0.6	-0.3	-1.0

NE = Not Evaluated

TABLE 12
WASTE 2: Performance Summary
W = Warning A = Corrective Action Recommended
NE = Not Evaluated

LAB ID	Ba	Ca	Cd	Cu	Cr	Fe	Mg	Mn	Mo	Pb	Sr	Zn
4101	A	A	NE	NE	S	S	NE	S	S	S	S	S
4102	S	S	S	S	S	S	S	S	S	S	S	S
4103	NE	W	S	S	S	S	S	S	S	S	S	S
4104	S	S	S	S	S	S	S	S	S	S	S	S
4105	NE	S	S	S	S	S	S	S	S	S	S	S
4106	S	S	S	S	S	S	S	S	S	S	S	S
4107	S	S	S	S	S	S	S	S	S	S	S	S
4109	S	S	S	S	S	S	S	S	S	S	S	S
4110	S	S	S	S	S	S	S	S	S	S	S	S
4111	W	W	W	W	W	W	W	W	W	W	W	W
4113	W	W	W	W	W	W	W	W	W	W	W	W
4116	S	S	S	S	S	S	S	S	S	S	S	S
4117	S	S	S	S	S	S	S	S	S	S	S	S
4118	NE											
4119	W	W	W	W	W	W	W	W	W	W	W	W
4120	S	S	S	S	S	S	S	S	S	S	S	S
4121	W	W	W	W	W	W	W	W	W	W	W	W
4122	S	S	S	S	S	S	S	S	S	S	S	S
4124	NE											
4125	S	S	S	S	S	S	S	S	S	S	S	S
4126	S	S	S	S	S	S	S	S	S	S	S	S
4130	S	S	S	S	S	S	S	S	S	S	S	S
4133	S	S	S	S	S	S	S	S	S	S	S	S
4136	S	S	S	S	S	S	S	S	S	S	S	S
4137	S	S	S	S	S	S	S	S	S	S	S	S
4138	W	W	W	W	W	W	W	W	W	W	W	W
4139	S	S	S	S	S	S	S	S	S	S	S	S
4140	S	S	S	S	S	S	S	S	S	S	S	S

5.0 DISCUSSION

At present, a comparison of the two studies is being undertaken and it is proposed to present these findings in a third report which will also discuss implications to regulatory requirements.

6.0 BIBLIOGRAPHY

1. Interlaboratory Study 2002-1 Toxicity Characteristic Leachate Procedure (TCLP), ISBN 0-7794-5569-1, Queen's Printer for Ontario, 2003
2. E9002 - The Preparation of Leachates Using the Toxicity Characteristic Leaching Procedure (TCLP). Laboratory Services Branch, Ontario Ministry of the Environment, November 2, 2003.
3. Statistical methods for use in proficiency testing by Interlaboratory Comparisons, Draft International Standard ISO/DIS 13528, 2002.
4. Proficiency testing by Interlaboratory Comparisons, CAN-P-43, Standard Council of Canada

**APPENDIX 1 - RAW DATA
(AS CONFIRMED BY PARTICIPANTS)**

TABLE 13 A
RAW DATA - LEACH 1

LAB ID	Al	As	Ba	Be	mg/L				Cr	Co	Cu	Fe	Pb	
					Res.	Qual.	Res.	Qual.						
4101	0.62	3.67	0.462	0	<0.05	0.444	642	5.39	0	<.05	0.309	21.8	5.25	
4102	1.01	2.51	0.5	0.005	<MDL	0.537	1238	5.01	0.02	0.11	24.28	4.75		
4103	0.714	2.5	MDL =	MDL =	0.529	1041	4.15	0.12	0.391	22.9	5.1			
4104	0.597	0.009	3.29	0.003	0.566	0.001	0.0002	<0.000	4.16	0.001	0.0178@0.000	0.327	21.50@ 5X dil.	
			@10X	dil.	2				250X dil.	8				4.4 0.003
4105	0.68	3.14	0.434	0	<0.001	0.401	1080	4.04	0.006	0.333	18.8	4.21		
4105	0.68	3.14	0.434	0	<0.001	0.401	1080	4.04	0.006	0.333	18.8	4.21		
4106	0.655	3.28	0.519	0.005	<0.005	0.506	1134	4.78	0.02	0.362	23.5	4.86		
4107	1	***<****	3.31	0.519	0.005	<****	1109	0.019	0.378	21.87	4.52			
4109	0.7	3.23	0.52	0.01	<	0.501	1000	4.65	0.018	0.354	21.2	4.78		
4110	0.709	3.3	0.52	0.001	<MDL	0.525	1150	4.7	0.0201	0.34	24	4.7		
4111	0.594	3.19	0.4769	0.0005	<MDL	0.498	1278	5.24	0.01979	0.365	26.3	5.18		
4113	0.72	3.3	0.503	0.01	<RDL	0.483	1000	4.51	0.02-RDL	0.352	20.7	4.69		
4116	0.8	3.52	0.546	0.0005	<MDL	0.546	1140	4.81	0.0218	0.465	22.1	4.85		
4117	0.6201	3.57	0.5334	0.01	< 0.023	0.5023	1025	5.047	0.0244	0.366	23.03	4.747		
4118	0.566	2.9	1	<	0.001	0.447	1140	3.91	0.017	0.305	19.3	3.57		
4119	0.93	3.46	0.511	0.0004	<0.001	0.465	1080	4.57	0.019	0.379	21.5	4.67		
4120	0.8	3.41	0.528	0.001	<MDL	0.493	1140	5.12	0.0201	0.361	23	4.77		
4121	0.42	<0.42	3.4	0.52	0.14	<0.14	0.5	1100	4.8	0.1 <0.1	1.1	5		
4122	0.673	3.5	0.5	0.1	<-0.1	0.6		5.2	0.1 <0.1	0.3	23.9	5.1		
4124	0.53	2.98	0.47	0.1	<RDL	0.546	1150	4.8	0.2 <RDL	0.42	23.2	5.48		
4125	0.68	3.2	0.5	0.001	<MDL	0.5	1100	5	0.02	0.3	24.3	5		
4126	1.25	2.9652	0.442	0.001	<MDL	0.347	1010	3.68	<MDL	0.368	16.3	3.77		
4130	0.673	2.935	0.525	0.001	<MDL	0.525	1100	4.42	0.018	0.399	20.3	4.43		
4133	20	84	50	2	<MDL	14	32260	116	0.5<MDL	26	460	114		
4136	0.84	4.1	0.511	0.001	<MDL	0.573	1140	4.82	0.022	0.432	23.3	5.26		
4137	0.77	3.3	0.51	0.001	<MDL	0.52	1100	4.6	0.018	0.37	21	4.7		
4138	0.21	3.25	0.32	<0.01	0.39	ND	2.75	0.02	0.29	12.7	3.02			
4139	0.723	2.96	0.508	0.004	<MDL	0.52	1180	4.54	0.021	0.368	24.6	4.92		
4140	0.69	3.7	0.56	0.02	<EQI	0.58	1110	5.3	0.021	0.37	23	5.7		

TABLE 13 B
RAW DATA - LEACH 1

LAB ID	Mg Res.	Mn Qual.	Mo Res.	Ni Qual.	Se Res.	Ag Qual.	Sr Res.	Tl Qual.	U Res.	V Qual.	Zn Res.	Qual.
	mg/L		mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	
4101 105	8.07	0.042	0.566	1.11	0	<.01	2.4	0	<.05	5.25	0	<.05
4102 110	7.87	0.05	0.66	0.616	0.005	2.288	0.005	<MDL	11.6	0.02	0	8.72
4103 99.2	7.35	MDL =	0.745	1	MDL =	1.395	MDL =	MDL =	MDL =	MDL =	0.5	7.92
4104 1150.07 @ 10X	6.2	0.001	0.041	0.001	0.552	0.0007	0.979	0.008	0.004	2.47	0.001	<0.001
							@ 10X			10.1 @ 10X	<0.0008	8
										0.004 @ 5X dil.		
4105	99.2	6.04	0.035	0.48	0.95	<0.005	1.8	0	<0.005	9.7	0	<0.005
4105	99.2	6.04	0.035	0.48	0.95	<0.005	1.8	0	<0.005	9.7	0	<0.005
4106	97.2	7.25	0.046	0.602	1	0.001	<0.001	2.39	0.01	<0.01	9.23	0.005 <0.005
4107	107	6.76	0.022	0.573	0.935	0.016	nm <nm	1.949	0.01	nm <nm	9.15	0.01 <0.005
4109	101	7	0.04	0.6	0.6	0.001	<	2.14	0.05	<	9.36	0.005 < 7.67
4110	110	6.9	0.033	0.65	1.04	0.001	<MDL	2.2	0.0073	9.5	0.0021	8.1
4111 106.65	7.99	0.037	0.624	0.882	0.0089	2.23	0.001	<MDL	10.19	0.001	<MDL	9.13
4113	107	6.85	0.041	0.596	0.957	0.02	<RDL	2.15	0.004	<RDL	9.45	0.03 <RDL
4116	111	7.16	0.045	0.642	1.06	0.01	2.33	0.004	<MDL	11.2	0.001	<MDL
4117	105.4	7.279	0.0481	0.5967	1.274	0.0367	2.326	0.006	<	9.646	0.05	< 7.307
4118	104	5.47	0.037	0.464	0.93	0.01	<	2.75	0.01	<	8.6	0.005 < 5.86
4119	108	6.91	0.082	0.579	1.02	<MDL	2.14	<MDL	8.44	<MDL	7.78	
4120	119	7.48	0.0491	0.646	0.951	0.001	<MDL	2.34	0.005	9.95	0.001	<MDL
4121	120	6.9	0.14	<0.14	0.1	<0.1	0.97	0.06	<0.06	2.2	0.2	<0.2
4122	6.597	0.0367	0.7	1.1	1.1	0.1	<0.1	2.05	0.001	11	0.1	<0.1
4124	119	7.43	0.25	0.58	1.69	0.1	<RDL	2.25	0.2	<RDL	8.6	0.1 <RDL
4125	110	7	0.04	0.6	1	0.001	<MDL	2	0.05	<MDL	8.6	0.04 <MDL
4126	101	5.72	<MDL	0.032	<MDL	0.454	<MDL	0.9865	1.94	<MDL	8.91	0.05 <MDL
4130	114	7.55	0.047	0.574	1.8	0.01	<MDL	2.07	0.02	<MDL	8.89	0.02 <MDL
4133	2100	179	4	17	26	0.5	<MDL	54	1	<MDL	290	1 <MDL 224.5
4136	121	7.56	0.05	0.66	1.2	0.002	<MDL	2.45			9.98	0.001 <MDL
4137	116	7	0.042	0.51	1.1	0.011	2.4	0.002	<MDL	9.7	0.003 <MDL	
4138	ND	4.23	0.01	0.36	0.84	0.03	ND	1.46	ND	<0.01	5.38	
4139	128	6.52	0.046	0.62	0.977	0.002	<MDL	2.21	0.006	9.31	0	7.78
4140	113	7.3	0.052	0.66	1.1	0.005	<EQL	2.4	0.02	<EQL	12	0.02 < EQL 8.5

TABLE 14 A
RAW DATA - LEACH 2
mg/L

LAB ID	AI	As	Ba	Be	Ca	Cr	Co	Cu	Fe	Pb	Res.	Qual.
	Res.	Qual.	Res.	Qual.	Res.	Qual.	Res.	Qual.	Res.	Res.	Qual.	Qual.
4101	0.63	3.61	0.47	0	<.05	0.59	6.7	0	<.05	0.311	22.3	6.69
4102	0.89	2.66	0.5	0.005	<MDL	0.68	6.37	0.02	0.1	0.1	23.88	6.11
4103	0.714	2.5	MDL =	MDL =	MDL =	0.645	1041	5.52	0.12	0.391	22.9	6.43
4104	0.57	0.009	3.25	0.003	0.56	0.001	0.0002	<0.000	0.581	0.0007	1170	2 @ 250X
			(@10X)	2	dil.	dil.	dil.	@5X	dil.	dil.	22.10.01 @ 5X dil.	6.380.02 @ 5X dil.
4105	0.682	3.17	0.434	0 <0.001	0.517	1080	5.31	0.005	0.341	18.8	5.47	
4106	0.682	3.17	0.434	0 <0.001	0.517	1080	5.31	0.005	0.341	18.8	5.47	
4106	0.677	3.24	0.522	0.005 <0.005	0.649	1117	6.13	0.019	0.364	23	6.24	
4107	1	3.26	0.519	0.005 <0.005	0.601	1130	6.11	0.018	0.387	22	5.77	
4109	0.72	3.36	0.53	0.01 <	0.668	1030	6.29	0.02	0.367	22	6.35	
4110	0.675	3.4	0.51	0.001 <MDL	0.704	1150	6.1	0.0198	0.36	24	6.2	
4111	0.589	3.2	0.47	0.0005 <MDL	0.636	1285	6.97	0.021	0.366	26.2	6.66	
4113	0.722	3.27	0.503	0.01 <RDL	0.613	993	5.8	0.02 <RDL	0.351	20.4	6.01	
4116	0.78	3.54	0.547	0.0005 <MDL	0.697	1120	6.3	0.0213	0.464	22.1	6.25	
4117	0.4588	3.557	0.5288	0.01 <0.6493	1018	6.414	0.0234	0.3629	22.73	6.106		
4118	0.562	3	1	< 0.001	< 0.569	1140	5.06	0.018	0.307	19.2	4.59	
4119	0.947	0.513	0.0003	<MDL	0.595	1190	5.92	0.019	0.385	21.5	6.03	
4120	0.8	3.44	0.53	0.001 <MDL	0.636	1080	6.38	0.0206	0.361	23	6.49	
4121	0.63	3.5	0.53	0.14 <0.14	0.7	1100	6.4	<0.1	0.4	24	6.3	
4122	0.695	3.4	0.5	0.1 <0.1	0.7	6.8	0.1	<0.1	0.3	23.7	6.6	
4124	0.58	3.66	0.48	0.1 <RDL	0.721	1170	6.38	0.2 <RDL	0.41	23.8	7.12	
4125	0.64	3.1	0.5	0.001 <MDL	0.6	1000	6	0.02	0.3	23.5	6	
4126	1.2	3.3016	0.443	< 0.455	1020	4.87	<			16.7	4.95	
4130	0.669	2.995	0.53	0.001 <MDL	0.671	1100	5.67	0.018	0.409	20.3	6.63	
4133	0.20	9.6	50	2 <MDL	18	32530	150	2	0.453	142		
4136	0.83	4.11	0.506	0.001 <MDL	0.725	1140	6.62	0.021	0.437	22.5	6.81	
4137	0.78	3.4	0.51	0.001 <MDL	0.66	1100	5.9	0.016	0.37	21	6.1	
4138	0.23	3.37	0.33	< 0.01	0.51	ND	3.71	0.02	0.3	13.2	4.08	
4139	0.755	2.99	0.52	<MDL	0.682	1160	5.93	0.021	0.369	21.5	6.34	
4140	0.677	3.16	0.55	0.02 <EQL	0.722	1060	6.8	0.02	0.37	21		

TABLE 14B
RAW DATA - LEACH 2
mg/L

LAB ID	Mg Res.	Mn Qual.	Mo Res.	Ni Qual.	Se Res.	Ag Qual.	Sr Res.	Ti Res.	U Res.	V Res.	Zn Res.	Qual.	
4101	105.7	7.7	0.042	0.563	1.42	0 <.01	2.43	0 <.05	6.69	0	<.05	8.59	
4102	111	7.77	0.05	0.64	0.808	0.005	2.283	0.005 <MDL	14.5	0.03	0	7.83	
4103	99.7	7.35	MDL = 0.5	0.745	1	MDL = 0.001	1.95	MDL = 1.0	MDL = 1.0	0.5	MDL = 0.5	7.67	
4104	116.0	0.07 @ 10X	7.25 @ 5X	0.005	0.04	0.001	0.546	0.007 @ 10X	2.44 @ 10X	0.001 <0.001	13.2 0.1 @ 10X	0.0008 <0.001	
4105	99.3	6.06	dil.	0.036	0.482	1.3	0 <0.005	1.81	0 <0.005	12.8	0 <0.005	6.96	
4105	99.3	6.06	0.036	0.482	1.3	0 <0.005	1.81	0 <0.005	12.8	0 <0.005	6.96		
4106	99.6	7.23	0.047	0.601	1.29	0.001 <0.001	2.36	0.01 <0.01	12	0.005 <0.005	7.65		
4107	106	6.8	0.022	0.592	1.21	0.018 ^{me<min}	1.94	0.01 ^{me<min}	11.9	0.01 ^{me<min}	7.05		
4109	103	7.32	0.05	0.63	1.27	0.001 <	2.24	0.05 <	12.7	0.005 <	7.96		
4110	110	7.1	0.033	0.66	1.38	0.001 <MDL	2.2	0.0073	12.8	0.002	8.2		
4111	106	8.01	0.04	0.619	1.14	0.0129	2.23	0.001 <MDL	12.4	0.001 <MDL	9.14		
4113	106	6.81	0.043	0.589	1.23	0.02 <RDL	2.15	0.01 <RDL	12.1	0.03 <RDL	7.16		
4116	111	7.16	0.045	0.644	1.35	0.012	2.33	0.004	14.6	0.001 <MDL	7.15		
4117	104.6	7.263	0.0483	0.5942	1.599	0.0323	2.34	0.006 <	12.59	0.05 <	7.275		
4118	105	5.46	0.038	0.462	1.2	0.01 <	2.75	0.01 <	11.7	0.005 <	5.84		
4119	108	6.91	0.045	0.577	1.33	<MDL	2.14	<MDL	12.4	<MDL	7.78		
4120	118	7.5	0.0473	0.641	1.24	0.001 <MDL	2.35	0.0039	12.6	0.001 <MDL	8.38		
4121	120	7.2	<0.14	0.1	<0.1	1.3	0.06 <0.06	2.1	0.2 <0.2	12	0.1 <0.1	9.1	
4122		6.768	0.0437	0.6	1.5	0.1 <0.1	2.12	0.001 <0.0004	12	0.1 <0.1	8.5		
4124	122	7.62	0.2 <RDL	0.63	1.88	0.1 <RDL	2.3	0.2 <RDL	11.5	0.1 <RDL	8.15		
4125	100	7	0.04	0.6	1.2	0.001 <MDL	2	0.05 <MDL	11	0.07 <MDL	7		
4126	101	<	<	< 1.3476	< 1.3476	< 1.3476	< 1.3476	< 1.3476	11.15	< 1.3476	< 1.3476		
4130	114	7.55	0.051	0.577	1.928	0.01 <MDL	2.07	0.02 <MDL	11.8	0.02 <MDL	8.47		
4133	2190	172	1 <MDL	16.5	37	0.5	56	1 <MDL	350	1 <MDL	217		
4136	121	7.68	0.047	0.66	1.5	0.004	2.48	0.002 <MDL	13.3	0.001 <MDL	8.43		
4137	114	7	0.043	0.51	1.4	0.013	2.4	0.002 <MDL	13	0.003 <MDL	7.6		
4138	ND	4.4	0.01	0.38	1.08	0.07	ND	1.55	ND	<0.01	5.47		
4139	128	6.75	0.046	0.627	1.24	0.002 <MDL	2.26	0.006 <EQL	12.4	0.002 <MDL	7.75		
4140	109	7.1	0.052	0.68	1.4	0.005 <EQL	2.3	0.02 <EQL	15	0.02 <EQL	8.3		

TABLE 15 A
RAW DATA - WASTE 1

mg/L

LAB ID	Al	As	Ba	Be	Cd	Ca	Cr	Co	Cu	F ₆	Pb
	Res.	Qual.	Res.	Qual.	Res.	Qual.	Res.	Qual.	Res.	Qual.	Res.
4101	0.42	0.011	0.128	0	<.05	<.01	325	0.974	0	<.05	0.106
4102	0.56	0.001	<MDL	0.3	0.005	<MDL	0.05	1848	0.36	0.01	<MDL
4103	MDL =	MDL =	MDL =	MDL =	MDL =	MDL =	MDL =	1532	0.282	0.125	0.055
4104	0.03	0.009	0.003	<0.003	0.353	@10X dil.	2	2030	2 @ 250X dil.	0.12	0.001
										0.002	<0.002
4105	0	<0.005	0	<0.03	0.277	0	<0.001	0.152	1570	0.183	0 <0.005
4106	0	<0.005	0	<0.03	0.277	0	<0.001	0.152	1570	0.183	0 <0.005
4106	0.054	0.005	<0.005	0.824	0.005	<0.005	0.641	1840	0.152	0.003	0.025
4107	1	1	1	1	0.03	1	1	1	1	1	1
4109	0.05	<	0.02	<	0.387	0.005	<0.005	0.863	1870	0.153	0.01
4110	0.0041	<	0.018	<	0.38	<	<	0.857	1660	0.13	0.002
4110	0.122	0.005	<MDL	0.164	0.0005	<MDL	0.0001	0.417	1890	0.19	0.004
4111	0.122	<RDL	0.1	RDL	0.526	0.01	<RDL	3.96	700	1.04	0.001
4113	0.02	<RDL	0.01	<MDL	0.326	0.0005	<MDL	0.588	2040	0.087	0.002
4116	0.03	<RDL	0.02	<0.3505	0.001	<0.001	<0.3419	1870	0.149	0.0022	0.025
4117	1.001	1	1	1	<	0.005	<	1.91	1566	0.192	0.054
4118	1.103	0.01	<MDL	0.214	0.0003	<MDL	0.0001	1.91	2330	0.08	0.005
4119	0.05	<MDL	0.029	0.368	0.001	<MDL	1.17	<MDL	1330	0.736	<MDL
4120	0.02	<MDL	0.029	0.368	0.001	<MDL	1.17	<MDL	1840	0.143	0.004
4121	0.42	<0.42	0.14	<0.14	0.8	0.14	<0.14	0.6	1720	0.2	0.1
4122	0.009	0.5	<5	0.3	0.1	<0.1	1	1	1980	0.2	<RDL
4124	0.3	<RDL	0.1	<RDL	0.4	<RDL	0.1	<RDL	1900	0.2	<RDL
4125	0.04	0.01	<MDL	0.3	0.01	<MDL	0.2	<MDL	1766	0.2	<MDL
4126	<	<MDL	0.3416	<	<MDL	0.3416	<	<MDL	2274	<	<MDL
4130	0.01	<MDL	0.001	<MDL	0.349	0.001	<MDL	1.04	1980	0.096	0.01
4133	130	3	<MDL	45	2	<MDL	8	53170	8	8.3	<MDL
4136	0.04	<MDL	0.15	0.368	0.001	<MDL	0.087	1910	0.367	0.001	0.205
4137	0.075	0.1	<MDL	0.37	0.001	<MDL	0.18	1900	0.25	0.025	0.077
4138	<0.01	<0.01	0.17	<0.01	0.17	<0.01	0.64	ND	0.05	<0.01	0.083
4139	0.01	<MDL	0.012	0.366	0	<MDL	0.968	1940	0.165	0	0.015
4140	0.1	<EQL	0.02	<EQL	0.36	0.02	<EQL	0.34	1790	0.21	0.01
										0.02	<EQL
										0.5	<EQL
										0.015	0.015

TABLE 15B
RAW DATA - WASTE 1

	mg/L												Zn								
LAB ID	Mg Res.	Mn Qual.	Mo Res.	Ni Qual.	Se Res.	Ag Qual.	Sr Res.	Ti Qual.	U Res.	V Qual.	Res.	Qual.	Res.	Qual.	Res.	Qual.	Res.	Qual.	Res.	Qual.	
4101 0	0 <1	0 <.01	2.37	0 <05	0.07	<01	0.402	0 <.05	0 <.05	0 <.05	0 <.05	0 <.05	0 <.05	0 <.05	0 <.05	0 <.05	0 <.05	0.311	0.311		
4102 77.47	0.01	0.35	0.02 <MDL	0.034	0.005 <MDL	0.054	0.005 <MDL	0.1 <MDL	0.05	0.1 <MDL	0.05	0.04	0.04	0.04	0.04	0.04	0.04	0.04	0.445	0.445	
4103 49.1	0.03	0.78	0.155	MDL =	MDL =	MDL =	MDL =	MDL =	1.0	0.001	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	0.5	0.5	
4104 87.5/0.07 @ 10X	0.283	0.001	0.072	0.001	0.028/0.007	0.065	0.008/0.004	1.16/0.001	0.001/0.001	0.03/0.0008	<0.000	8 @ 10X	8 @ 10X	35.6	0.008						
4105 82.5	0.13	0.121	0 <01	0.001	0 <005	0.843	0 <005	0.843	0 <005	0 <005	0 <005	0 <005	0 <005	0 <005	0 <005	0 <005	0 <005	5.27	5.27		
4105 82.5	0.13	0.121	0 <01	0.001	0 <005	0.843	0 <005	0.843	0 <005	0 <005	0 <005	0 <005	0 <005	0 <005	0 <005	0 <005	0 <005	5.27	5.27		
4106 76.3	0.37	0.074	0.04	0.077	0.001 <0.001	1.13	0.014 <0.001	0.014 <0.001	0.014 <0.001	0.014 <0.001	0.014 <0.001	0.014 <0.001	0.014 <0.001	0.014 <0.001	0.014 <0.001	0.014 <0.001	0.014 <0.001	0.014 <0.001	26	26	
4107 102	0.92	0.038	0.05	0.05	0.01 <0.001	0.94	0.001 <0.001	0.001 <0.001	0.001 <0.001	0.001 <0.001	0.001 <0.001	0.001 <0.001	0.001 <0.001	0.001 <0.001	0.001 <0.001	0.001 <0.001	0.001 <0.001	0.001 <0.001	51.2	51.2	
4109 82.6	0.53	0.06	0.04	0.06	0.001 <0.001	<1	0.001 <0.001	1.09	0.0019 <0.001	0.0019 <0.001	0.0019 <0.001	0.0019 <0.001	0.0019 <0.001	0.0019 <0.001	0.0019 <0.001	0.0019 <0.001	0.0019 <0.001	0.0019 <0.001	38.9	38.9	
4110 81.8	0.157	0.116	0.092	0.158	0.001 <MDL	0.439	0.0005 <MDL	0.439	0.001 <MDL	14	14										
4111 0.16	0.001 <MDL	2.1	0.002 <MDL	0.081	0.0005 <MDL	0.439	0.0005 <MDL	0.439	0.001 <MDL	0.011	0.011										
4113 133	4.96	0.03 <RDL	0.255	0.1 <RDL	0.02 <RDL	0.16	0.001 <RDL	0.16	0.001 <RDL	855	855										
4116 83.8	0.26	0.07	0.03	0.07	0.001 <0.001	1.05	0.001 <0.001	1.05	0.004 <0.001	0.004 <0.001	0.004 <0.001	0.004 <0.001	0.004 <0.001	0.004 <0.001	0.004 <0.001	0.004 <0.001	0.004 <0.001	0.004 <0.001	20.2	20.2	
4117 80.12	0.1173	0.1223	0.0155	0.0912	0.0292	0.0292	0.0292	0.0292	0.006 <0.001	0.006 <0.001	0.006 <0.001	0.006 <0.001	0.006 <0.001	0.006 <0.001	0.006 <0.001	0.006 <0.001	0.006 <0.001	0.006 <0.001	8.951	8.951	
4118 158	1.87	0.027	0.093	0.11	0.01 <0.001	<1	0.01 <0.001	1.5	0.01 <0.001	0.01 <0.001	0.01 <0.001	0.01 <0.001	0.01 <0.001	0.01 <0.001	0.01 <0.001	0.01 <0.001	0.01 <0.001	0.01 <0.001	218	218	
4119 24.6	<MDL	1.85	<MDL	<MDL	0.081	<MDL	0.686	0.686	0.0014 <MDL	65	65										
4120 115	0.93	0.0553	0.094	0.094	0.001 <MDL	0.123	0.001 <MDL	0.123	0.0014 <MDL	29.2	29.2										
4121 79.7	0.74	0.14 <0.14	0.1 <0.1	0.16 <0.1	0.06 <0.06	0.9	0.06 <0.06	0.9	0.2 <0.2	0.16 <0.16	0.16 <0.16	0.16 <0.16	0.16 <0.16	0.16 <0.16	0.16 <0.16	0.16 <0.16	0.16 <0.16	0.16 <0.16	48.7	48.7	
4122 0.67	0.0541	0.2	0.2 <RDL	0.5 <RDL	0.065	0.065	0.065	0.065	0.1 <MDL	48.7	48.7										
4124 97.2	0.53	0.2 <RDL	0.5 <RDL	1.08	0.1 <RDL	1.08	0.1 <RDL	1.08	0.2 <RDL	0.5 <RDL	49.1	49.1									
4125 88	0.1	0.2 <RDL	0.02 <MDL	0.065	0.065	0.065	0.065	0.065	0.01 <MDL	5.2	5.2										
4126 71.98	<	<	<	<	0.0085	0.0085	1	0.01 <MDL	0.928	0.02 <MDL	35.34	35.34									
4130 103	1.06	0.046	0.053	0.053	0.0085	1	0.01 <MDL	0.928	0.02 <MDL	60.5	60.5										
4133 1950	16	6	7.2	5	0.5	0.5	0.5	0.5	25.5	1 <MDL	5 <MDL	349	349								
4136 104	0.07	0.305	0.02 <MDL	0.2	<MDL	0.002 <MDL	0.17	0.002 <MDL	0.17	0.002 <MDL	0.064	0.064	0.064	0.064	0.064	0.064	0.064	0.064	2.1	2.1	
4137 91	0.049	0.18	0.01 <MDL	0.2	<MDL	0.004 <MDL	1.1	0.004 <MDL	1.1	0.002 <MDL	0.99	0.99	0.99	0.99	0.99	0.99	0.99	0.99	4.6	4.6	
4136 46.5	0.33	0.03	0.03	0.03	0.03	0.03	0.03	0.03	<0.01	ND	50.3	50.3									
4139 103	0.409	0.07	0.041	0.097	0	<MDL	1.14	0.01 <MDL	1.14	0.01 <MDL	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	39.3	39.3
4140 92.2	0.14	0.13	0.02 <EQL	0.07	0.005 <EQL	1	0.02 <EQL	0.001 <EQL	0.02 <EQL	0.02 <EQL	0.02 <EQL	0.02 <EQL	0.02 <EQL	0.02 <EQL	0.02 <EQL	0.02 <EQL	0.02 <EQL	0.02 <EQL	7	7	

TABLE I6 A
RAW DATA - WASTE 2

LAB ID	Al	As	Ba	Be	Cd	Ca	Cr	Co	Cu	Fe	Pb	Res.	Qual.	Res.	Qual.	Res.	Qual.	Res.	Qual.	Res.	Qual.	Res.	Qual.	Res.	Qual.			
4101	0.341	0.011	<MDL	0.133	0	<.05	0	278	0.798	0	<.05	0	<.01	278	0.798	0	<.01	0.643	0	<.01	0.643	0	<.01	0.643	0	0.662		
4102	0.49	0.001	<MDL	0.4	0.005	<MDL	1.56	1893	0.12	0.01	<MDL	0.1	<MDL	0.1	<MDL	0.1	<MDL	0.1	<MDL	0.1	<MDL	0.1	<MDL	0.1	<MDL	0.1	0.662	
4103	MDL =	1576	0.211	0.125	0.85	0.189	0.189	0.189	0.189	0.189	0.189	0.189	0.189	0.189	0.189	0.189	0.189	0.189	0.189	0.189								
4104	0.02	0.009	0.003	<0.003	0.423	0.001	0.0002	<0.001	1.77	0.0007	2060	2 @ 250X dil.	0.081	0.001	0.0027	0.0098	0.016	0.001	0.002	0.002	1.14	0.003	0.003	0.003	0.003	0.003	0.003	
4105	0.006	0	<0.03	0.438	0	<0.001	2.47	1330	0.049	0.007	0.058	0.018	0.018	0.018	0.018	0.018	0.018	0.018	0.018	0.018	0.018	0.018	0.018	0.018	0.018	0.018		
4105	0.006	0	<0.03	0.438	0	<0.001	2.47	1330	0.049	0.007	0.058	0.018	0.018	0.018	0.018	0.018	0.018	0.018	0.018	0.018	0.018	0.018	0.018	0.018	0.018			
4106	0.05	<0.05	0.005	<0.005	0.87	0.005	<0.005	1.52	1790	0.099	0.004	0.088	0.018	0.018	0.018	0.018	0.018	0.018	0.018	0.018	0.018	0.018	0.018	0.018	0.018	0.018		
4107	1	<0.005	0.03	<0.005	0.486	0.005	<0.005	1.49	1904	0.124	0.01	<0.001	0.094	0.094	0.094	0.094	0.094	0.094	0.094	0.094	0.094	0.094	0.094	0.094	0.094	0.094		
4109	0.05	<	0.02	<	0.46	0.01	<	1.83	1530	0.09	0.003	0.024	0.03	0.03	0.03	0.03	0.03	0.03	0.03	0.03	0.03	0.03	0.03	0.03	0.03	0.03		
4110	0.0052	0.02	0.61	0.001	<MDL	1.82	1870	0.128	0.0066	0.032	0.02	<MDL	1.05	1.05	1.05	1.05	1.05	1.05	1.05	1.05	1.05	1.05	1.05	1.05	1.05	1.05	1.05	
4110	0.0052	0.02	0.61	0.001	<MDL	1.82	1870	0.128	0.0066	0.032	0.02	<MDL	1.05	1.05	1.05	1.05	1.05	1.05	1.05	1.05	1.05	1.05	1.05	1.05	1.05	1.05	1.05	
4111	0.044	0.044	0.005	<MDL	0.18	0.0005	<MDL	0.0001	715	0.915	0.001	<MDL	0.002	<MDL	0.002	<MDL	0.002	<MDL	0.002	<MDL	0.002	<MDL	0.002	<MDL	0.002	<MDL	0.002	
4113	0.2	<RDL	0.1	<RDL	0.733	0.001	<RDL	4.62	1860	0.084	0.02	<RDL	0.203	0.203	0.203	0.203	0.203	0.203	0.203	0.203	0.203	0.203	0.203	0.203	0.203	0.203	0.203	
4116	0.03	0.01	<MDL	0.445	0.0005	<MDL	1.56	1830	0.0987	0.0042	0.048	0.007	0.007	0.007	0.007	0.007	0.007	0.007	0.007	0.007	0.007	0.007	0.007	0.007	0.007	0.007		
4117	1.109	0.02	<	0.45	0.001	<	1.459	1575	0.1065	0.0275	0.019	0.059	0.059	0.059	0.059	0.059	0.059	0.059	0.059	0.059	0.059	0.059	0.059	0.059	0.059	0.059		
4118	0.03	0.01	1	<	0.005	<	2.96	2170	0.061	0.006	0.064	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01		
4119	0.04	<MDL	0.245	<MDL	<MDL	<MDL	<MDL	1210	0.505	<MDL	<MDL	<MDL	<MDL	<MDL	<MDL	<MDL	<MDL	<MDL	<MDL	<MDL	<MDL	<MDL	<MDL	<MDL	<MDL	<MDL		
4120	0.02	<MDL	0.0031	0.502	0.001	<MDL	2.32	1840	0.104	0.0062	0.043	0.24	1.89	1.89	1.89	1.89	1.89	1.89	1.89	1.89	1.89	1.89	1.89	1.89	1.89	1.89	1.89	
4121	0.42	<0.42	0.134	0.72	0.14	<0.14	1.4	1950	0.19	0.1	<0.1	0.3	<0.3	0.3	<0.3	0.3	<0.3	0.3	<0.3	0.3	<0.3	0.3	<0.3	0.3	<0.3	0.3		
4122	0.01	0.5	<0.5	0.4	0.1	<0.1	2.2	1940	0.1	<RDL	2.73	1940	0.2	<RDL	0.1	<RDL	0.1	<RDL	0.1	<RDL	0.1	<RDL	0.1	<RDL	0.1	<RDL	0.1	
4124	0.3	<RDL	0.1	<RDL	0.49	0.1	<RDL	2.73	1940	0.1	<RDL	2.73	1940	0.2	<RDL	0.1	<RDL	0.1	<RDL	0.1	<RDL	0.1	<RDL	0.1	<RDL	0.1	<RDL	0.1
4125	0.08	<MDL	0.01	<MDL	0.4	0.01	<MDL	1.2	1800	0.1	<MDL	1.2	1800	0.1	<MDL	0.03	<MDL	0.03	<MDL	0.03	<MDL	0.03	<MDL	0.03	<MDL	0.03		
4126	<	0	<MDL	0.4181	<	1.114	1680	<	1.114	1680	<	1.114	1680	<	1.114	1680	<	1.114	1680	<	1.114	1680	<	1.114	1680	<	1.114	
4130	0.01	<MDL	0.001	<MDL	0.441	0.001	<MDL	2.62	1830	0.063	0.01	<MDL	0.039	0.039	0.039	0.039	0.039	0.039	0.039	0.039	0.039	0.039	0.039	0.039	0.039	0.039	0.039	
4133	10	15	45	2	34	52440	5	1830	0.237	0.002	0.02	12	12	12	12	12	12	12	12	12	12	12	12	12	12	12	12	
4136	0.04	<MDL	0.14	0.416	0.001	<MDL	0.468	1890	0.12	0.01	<MDL	0.034	0.034	0.034	0.034	0.034	0.034	0.034	0.034	0.034	0.034	0.034	0.034	0.034	0.034	0.034	0.034	
4137	0.067	0.1	<MDL	0.45	0.001	<MDL	1.2	1800	0.12	0.01	<MDL	0.034	0.034	0.034	0.034	0.034	0.034	0.034	0.034	0.034	0.034	0.034	0.034	0.034	0.034	0.034	0.034	
4138	<0.01	<0.01	<0.01	0.21	<0.01	1.17	ND	0.04	0.01	<0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	
4139	0.01	<MDL	0.012	0.468	0	<	1.41	1950	0.135	0.01	<MDL	0.013	0.013	0.013	0.013	0.013	0.013	0.013	0.013	0.013	0.013	0.013	0.013	0.013	0.013	0.013	0.013	
4140	0.1	<EQL	0.02	<EQL	0.48	0.02	<EQL	1.6	1710	0.11	<EQL	0.023	0.023	0.023	0.023	0.023	0.023	0.023	0.023	0.023	0.023	0.023	0.023	0.023	0.023	0.023	0.023	

TABLE 16B
RAW DATA - WASTE 2

LAB ID	Mg Res.	Qual.	Mn Res.	Qual.	Mo Res.	Qual.	Ni Res.	Qual.	Se Res.	Qual.	Ag Res.	Qual.	Sr Res.	Qual.	Ti Res.	Qual.	U Res.	Qual.	V Res.	Qual.	Zn Res.	Qual.
4101	0	<1	0	<.01	2.03	0	<.05	0.066	0	<.01	0.343	0	<.05	0	<.05	0	<.05	0	<.05	0.332		
4102	100	1.7	0.088	MDL =	0.03	0.06	MDL =	0.156	0.036	0	<MDL	0.93	0.005	<MDL	0.1	<MDL	0.04	<MDL	66.23	MDL =		
4103	68	0.088								MDL =	MDL =	0.884	MDL =	MDL =	MDL =	MDL =	MDL =	MDL =	MDL =	2.97		
4104	91.8	0.07 @ 10X	1.1	0.001	0.077	0.001	0.05740.00077	0.067	0.008	0.004	<0.004	1.05	0.001	0.001	<0.001	0.11	0.01	0.0008	<0.001	123	.008 @10X	
4105	97.2	4.37			0.019	0.147	0.001		0	<0.005	0.761		0	<0.005	0	<0.001	0	<0.005	331			
4105	97.2	4.37			0.019	0.147	0.001		0	<0.005	0.761		0	<0.005	0	<0.001	0	<0.005	331			
4106	81.3	2	0.04	0.085	0.04	0.085	0.074	0.001	<0.001	1.08	0.01	<.01	0.01	<.01	0.01	<.01	0.005	<.005	90.9			
4107	119	2.31	0.022	0.075	0.022	0.075	0.05	0.05	0.01	<***	0.944	0.01	<***	0.01	<***	0.016	<***	0.016	88			
4109	83.9	1.97	0.03	0.03	0.036	0.05	0.05	0.001	0.0016	0.93	0.001	<0.005	0.001	<0.005	<	0.005	<	0.005	<	111		
4110	99.8	1.77	0.05	0.001 < MDL	2.05	0.002 < MDL	0.074	0.0005	< MDL	0.441	0.0014	< MDL	0.01	< MDL	0.01	< MDL	0.01	< MDL	0.014			
4111	0.6	0.001	< MDL							<RDL	0.1	<RDL	1.08	0.01	<RDL	0.03	<RDL	0.03	<RDL	1040		
4113	133	6.01	0.03	<RDL	0.242	0.037	0.078	0.067	0.002	1.06	0.004	<MDL	0.05	<MDL	0.05	<MDL	0.01	<MDL	59.6			
4116	104	1.74	0.037	0.037	0.037	0.078	0.067	0.0386	0.0893	0.0893	0.0386	0.006	<	1	<	0.05	<	45.8				
4117	91.31	1.294	0.0857	0.0857	0.0583	0.0583	0.0893	0.0893	0.0386	0.0386	0.0386	0.006	<	1	<	0.05	<	47.7				
4118	149	3.73	0.02	0.02	0.13	0.02	0.01	0.01	<MDL	0.12	0.01	<MDL	1.36	0.01	<	0.05	<	0.05	<			
4119	42.7	1.15	<MDL						0.06	<MDL	0.671	0.001	<MDL	0	<MDL	0	<MDL	0	<MDL			
4120	118	2.87	0.0337	0.145	0.0337	0.145	0.1	<0.1	0.096	<MDL	1.17	0.0023	0.0001	<MDL	0.001	<MDL	183					
4121	130	1.86	0.14	<0.14	0.1	0.14	0.1	<0.1	0.16	0.06	<0.06	1	0.2	<0.2	0.16	0.1	<0.1	81.7				
4122	2.093	0.0277	0.1	<0.1	0.1	0.0277	0.1	0.5	<0.1	0.1	<0.1	0.94	0.0082	0.0004	<0.004	0.1	<0.1	146				
4124	110	2.28	0.2	<RDL	0.5	<RDL	0.62	0.1	<RDL	1.06	0.2	<RDL	5	<RDL	0.1	<RDL	0.1	<RDL	192			
4125	100	1.6	0.1	<MDL	0.06	0.06	0.072	0.01	<MDL	1.1	0.5	<MDL	0.04	<MDL	0.07	<MDL	0.07	<MDL	42			
4126	80.3	1.741	<	<					<MDL	0.01	<MDL	0.9485	0.005	<MDL	0.001	<MDL	0.001	<MDL	183			
4130	102	2.96	0.019		0.106	0.00984	0.00984	0.01	<MDL	0.866	0.02	<MDL	0.01	<MDL	0.02	<MDL	0.02	<MDL	246			
4133	2893	57	3	2	0.02	<MDL	0.2	0.2	<MDL	0.5	0.004	<MDL	1.16	0.002	<MDL	1.1	0.002	<MDL	1.1	<MDL		
4136	134	0.677	0.14	0.045	0.045	0.01	<MDL	0.2	<MDL	0.004	<MDL	1.1	0.002	<MDL	0.058	0.003	<MDL	0.058	10.8			
4137	102	1.1	0.045	0.045	0.045	0.01	<MDL	0.2	0.03	<0.01	ND	1.06	0.005	<MDL	1.13	0.005	<MDL	1.13	<0.01			
4138	96	1.16	0.02	0.02	0.05	0.05	0.061	0.096	0	<MDL	1.13	0.005	<MDL	0	<MDL	0	<MDL	0	5			
4139	134	1.93	0.055	0.055	0.046	0.071	0.005	0.071	0.005	<EQL	0.98	0.02	<EQL	0.001	<EQL	0.02	<EQL	0.02	<EQL	8.7		

APPENDIX 2 - LIST OF PARTICIPANTS

Accutest Laboratories Ltd., Nepean Ontario
Activation Laboratories Ltd. Ancaster, Ontario
AGAT Laboratories, Mississauga, Ontario
AGAT Laboratories, Calgary, Alberta
AMEC Earth & Environmental, Edmonton, Alberta
AMEC Earth & Environmental Ltd, Mississauga, Ontario
Caduceon Environmental Laboratories, Ottawa, Ontario
Entech - A Division of Agri-Service Laboratory Inc., Mississauga, Ontario
Enviro-Test Laboratories Manitoba Technology Centre Ltd., Winnipeg, Manitoba
Enviro-Test Laboratories - Sentinel Division, Waterloo, Ontario
Fisher Environmental Laboratories, Markham, Ontario
Lambton Scientific (Division of Technical Chemical Services Inc.), Sarnia, Ontario
Maxxam Analytics, Mississauga, Ontario
Maxxam Analytics Inc., Calgary, Alberta
Centre d'Expertise en Analyse Environnementale du Quebec, Laval, Quebec
Norwest Labs, Edmonton, Alberta
Ontario Ministry of Environment, Laboratory Services Branch, Etobicoke, Ontario
Paracel Laboratories Ltd., Ottawa, Ontario
Philip Analytical Services Inc., Mississauga, Ontario
Philip Analytical Services, Burlington, Ontario
PSC Analytical Services Inc., Bedford, Nova Scotia
PSC Analytical Services Inc., Edmonton, Alberta
PSC Analytical Services Inc., London
PSC Analytical Services Inc., Burnaby, British Columbia
Queen's Analytical Services Unit, Kingston, Ontario
R & R Laboratories Ltd., Peterborough, Ontario
TESTMARK Laboratories Ltd., Sudbury, Ontario
York-Durham Regional Environmental Laboratory, Pickering, Ontario

APPENDIX 3 - CORRESPONDENCE

Quality Management Unit

January 9, 2004

RE: MOE Interlaboratory Study 04-1

Thank you for your response to the invitation to participate in MOE Interlaboratory Study 04-1, Toxicity Characteristic Leaching Procedure (TCLP). Please find enclosed a copy of the Laboratory Services Branch (LSB) method E9002. Study participants are requested to use either the enclosed method OR US-EPA method 1311 for the processing of the solid samples provided as part of this interlaboratory study. A copy of EPA Method 1311 may be downloaded from the following web-site:

http://www.ene.gov.on.ca/envision/env_reg/er/documents/2000/RA00E0002.htm

(Please refer to the last item on this page: 2. Toxicity Characteristic Leaching Procedure (TCLP) 288 KB.)

In order to ensure consistency in the application of the method, we request that critical steps as outlined in the attachment Instruction Sheet be strictly followed. Please read this document before you open the test materials and start the analysis. Also note that the analytical methods listed in section 1.1.2 ARE NOT a requirement of this study. Participants may use their own method of choice to determine the target analytes in Table 1. This follow-up study includes regulation metals and additional common metals that are typical to this analysis. A methodology questionnaire and data reporting file are being forwarded by e-mail.

Table 1 - Target Analytes

Aluminum (Al)	Chromium (Cr)	Magnesium (Mg)	Strontium (Sr)	Selenium (Se)
Barium (Ba)	Cobalt (Co)	Manganese (Mn)	Titanium (Ti)	Uranium (U)
Beryllium (Be)	Copper (Cu)	Molybdenum (Mo)	Vanadium (V)	
Cadmium (Cd)	Iron (Fe)	Nickel (Ni)	Zinc (Zn)	
Calcium (Ca)	Lead (Pb)	Silver (Ag)	Arsenic (As)	

Please do not hesitate to contact us if you have any questions regarding this interlaboratory study.

Your confidential Study ID Code is:

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INSTRUCTION SHEET

MOE INTERLABORATORY STUDY 04-1 TOXIC CHARACTERISTIC LEACHING PROCEDURE (TCLP)

STUDY MATERIALS:

Provided are:

- a) Two fortified waste leachates (acidified)
- b) Two waste materials
They are ground and dried and ready for use. No further preparation is required.
- c) Two plastic bottles (1250 mL wide mouth) for making leachate in.

Caution: Please ensure that your analytical and handling procedures for these materials have been fully assessed for safety and that all specified precautions are taken.

LEACHING PROCESS:

1. Omit for this study, the steps used for determining choice of Leaching Fluid.
2. **Please use the Acid Fluid (2)**
Extraction FLUID 2 (pH 2.88 +/- 0.05), ACID, must be used. This is made by using 5.7 mL glacial acetic acid per 1.0 L of reagent water, see 5.7.1 of method.
Note: Please: Do NOT use the Buffer Fluid (1)
3. It is suggested that the supplied 1250 mL plastic bottles be used. This allows a 50 g sample portion and 1000 mL of fluid. If a smaller portion is used, such as 25 g and 500 mL, please use a container that allows adequate headspace so that agitation within the bottle is possible.
4. Use the ratio of 1:20 for solid waste sample : fluid.
5. Tumble the extraction bottle at 30 rpm for 18 +/- 2 hours. For this exercise try to be as close to 18 hours as possible.
6. Filter the leachate through a 0.7 micron glass fibre filter (acid washed).
7. Record the pH of this leachate before sample preservation.
8. Preserve the final leachate with 2 mL HNO₃/ 1.0 L, or as required to pH<2.

LEACHATE ANALYSIS:

Ensure leachates, both provided and generated by leaching waste are appropriately digested prior to analysis.

Using acid fluid 2 :	Waste 1	Waste2
pH of Leachate after filtering		
pH of Leachate after preservation (use HNO ₃ to pH <2)		

DATA REPORTING

All analytical data are to be reported electronically using the enclosed Excel® spreadsheet, **Data.xls**. An electronic copy of the reporting sheet will also be provided to you via e-mail. An electronic version of the Study Questionnaire will also be sent via e-mail. All relevant information regarding the preparation and analysis of the samples is to be recorded in the Excel® spreadsheet, **Questionnaire.xls** and reported electronically. All results are due by **April 23, 2004** and should be reported via e-mail to Rita Dawood at rita.dawood@ene.gov.on.ca and/or Sathi Selliah at sathi.selliah@ene.gov.on.ca.

